

EXAMPLE

ABCD-0012 - Autonomous Navigation and Attitude Reference System (ANARS)

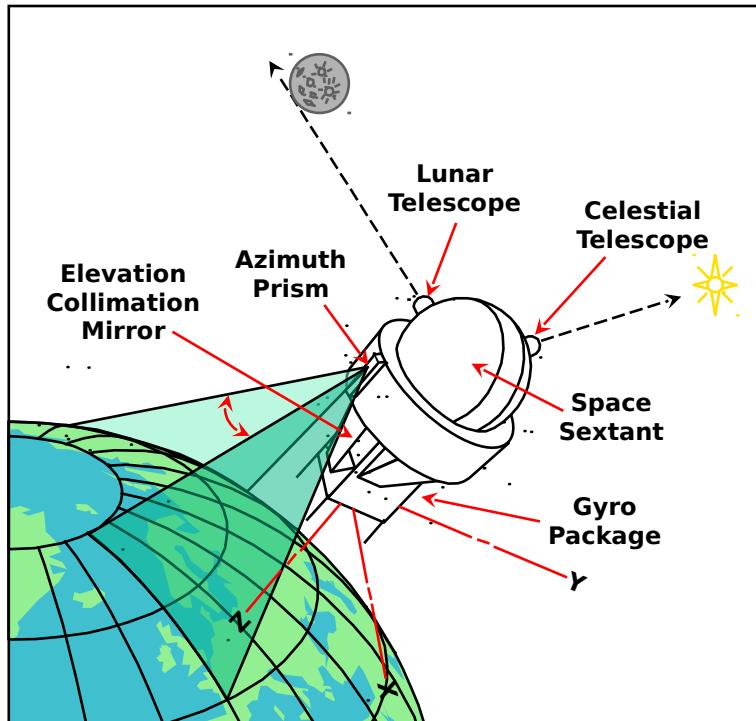
Concept

Objective: Investigate the use of an onboard autonomous spacecraft navigation capability.

- Independent of ground control
- Sustain approximate orbital accuracy of ± 800 ft
- Emergency back-up operation for primary ground station failure due to catastrophic or hostile action

Description: Observes stars and lunar limb offset angles from nadir reference gyro by means of space sextant. Earth azimuth and elevation are optically referenced.

Equipment:



Descriptive Graphic

- Lunar telescope
- Celestial star telescope
- Azimuth prism
- Gyro package
- Elevation collimation mirror
- Space Sextant

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Justification

- **Military Relevance**
 - AFSPC MNS 003-91
 - Supports operational requirements for NPOESS, SBIRS
 - Addresses satellite navigation deficiency identified in AFSPC MAP's
 - Potential applications to existing operational systems such as AWS, DMSP, Future communication systems
 - Technology base new initiative for "Survivable Satellite" ACTD #123
- **Need for Spaceflight**
 - Test for accuracy not achievable on the ground
 - Tracking rates unrealistic if tried from ground/air
 - Required for risk-reduction prior to deployment of first SBIRS in FY03
- **Comparison to Alternatives**
 - ANARS ± 800 ft and 1 arc sec pointing accuracy
 - GPS more accurate (± 10 ft) but does not provide autonomy
 - NASA's SANS program not fully autonomous, less accurate

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Detailed Overview

- **Flight Data:**
 - Free-flyer: 900 (± 50) km, Circular orbit, $>90^\circ$ Inclination
 - 1 flight required (12 months duration) to meet objectives
 - 1.5 m³, 182 kg, nominal 250 W
- **Status:**
 - Hardware fabricated; modifications required to gyro package and elevation collimation mirror
 - CDR Complete July 2000
 - Flight Ready 4Q FY 02
- **Priority:**
 - 2000 AF SERB 2/26
 - 1999 DoD SERB 5/40
- **Requested STP Services**
 - ✓ Launch Services
 - ✓ Launch Integration
 - ✓ Spacecraft Development
 - ✓ Operations
 - ✓ Spacecraft/Experiment Integration
 - ✓ Data Distribution
- **Funding:**
 - Total Cost: \$18.7M
 - No out of budget requests/requirement
 - Experiment 90% funded through completion

	Prior	FY00	FY01	FY02
FY03				
Req't	\$2.4M \$0.6M	\$3.1M	\$7.2M	\$5.4M
Actual	\$2.4M	\$3.1M	\$6.5M	\$4.8M

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Summary of Data Application

- The Air Force Research Lab's Space Vehicles Branch and DARPA will utilize the data from this experiment to develop a guidance system which allows two satellites to effect an orbital rendezvous without human input
- This data will ultimately enable formations of satellites to autonomously transfer from a communication mission configuration to a reconnaissance mission configuration
- The data analysis will be complete 18 months after the experiment is launched
- Applicable category of this research is Applied Research

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Flight Mode Suitability

<u>Flight Mode Satisfied</u>	<u>% Experiment Objectives</u>
Shuttle	0%
Shuttle Deployable	15%
Shuttle Deployable with Propulsion	40%
International Space Station	25%
“Piggyback” Free-flyer on ELV	80%

How important is it to retrieve your flight hardware for analysis or reflight? Can you place a dollar value on this? What is it?

Not necessary for this experiment.